



# Turkey Red Media

## A GUIDE ON HOW TO CHOOSE A DRONE OPERATOR FOR YOUR TV, FILM, VIDEO OR MEDIA PRODUCTION.

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## SUMMARY

There are as of writing over 2,200 licensed Drone operators in the UK. This guide is intended to offer assistance and advice on how choose one of these Drone operators for your video or film production. It is important to ensure you choose a legal and capable operator that can meet your aerial filming requirements.

Not all Drone operators offer services to the TV, Film and Video Industry. Capabilities can vary and range from low end GoPro carrying aircraft to large aircraft utilised on large film production sets, that are able lift large heavy cameras, such as Red's. The vast majority of Drone operators are small companies focusing on specific markets and geographical areas. When choosing a Drone company it is important you understand their capabilities, equipment, approvals and skills.

Drone approvals are separated into two weight classes by the UK Civil Aviation Authority, (UK CAA). These are over 7kg and sub 7kg, strict limitations are placed on where aircraft over 7kg can fly, for example they are not normally allowed in urban areas / congested areas. For aircraft over 7kg flying in "controlled airspace" extra approvals are required.

The majority of legal operators are approved and have permissions for flying sub 7kg aircraft. These aircraft typically can carry cameras and gimbals for small SLR cameras such as the Sony A6000, Panasonic GH4, Sony A7 series, and the DJI X5. At the lower end of the market operators will utilise cameras such as DJI's own X3 Camera on the Inspire Drone and various Phantom Cameras and Drones. Operators offering aircraft to carry heavier cameras such as the ARRI, Red and Canon 5D, will charge a premium to do so. As these aircraft are expensive to own and operate, and will normally require two operators. They may also require extra approvals from the UK CAA especially for flights in urban areas.

Smaller Drone's such as the Phantom 3 and 4's, and the DJI Inspire are the lowest cost option for productions with tight budgets, but have some limitations in terms of quality of footage, and safety.

## LICENSED / APPROVED

In the UK all Drone operators offering commercial services must be licensed and approved by law. Pilots must have a recognised qualification; there are many companies offering CAA qualifications these days. From the BNUC-S and RPQ-S to the UAQ and others. Once a pilot has one of these qualifications then they can apply to the UK Civil Aviation Authority for their "Permission For Commercial Operations", (PfCo). The PFCO is renewed annually as is issued for the classification of the aircraft on which the Pilot passed their qualification. All approved operators should be able to provide copies of their PFCO. If the operator cannot provide this document, then they are probably operating illegally. This means they will be uninsured, and will not have the correct processes and procedures to ensure safe operations.

## URBAN OPERATIONS

As standard permission, flight operations in urban areas are possible for aircraft weighing less than 7kg, or for operators that have obtained extra permissions from the CAA based on safety cases. Standard sub 7kg permissions allow for urban operations, but not within 50m of anyone or anything not under the pilots control. This can be managed and achieved by the use of barriers, road closures, and ground / safety staff as required. Extra safety personnel for urban operations may add to the cost of Drone operations, however the Drone operator may be willing to use the clients on staff with appropriate briefing and training.

## INSURANCE

As part of any operator's condition of their PFAW, they must have valid insurance. The insurance is specialist and aviation specific. Normally this will offer £3m / £5m public liability and cover for the aircraft and camera lost or damaged in flight. Some policies may have exemptions for certain high risk environments. We would recommend that clients satisfy themselves that the insurance policy is appropriate for the operations being undertaken.

## HOW HIGH, HOW FAR..

All operators must operate their aircraft under Visual Line of Site rules, (VLOS). Standard permission for operators allows for flights above or below 400ft from the pilot, and at a distance of up to 500m. It is worth bearing in mind that the further the aircraft is away from the operator, the more difficult the pilot will be able to judge the aircrafts distance from objects. This is due to the pilot's depth of field reducing the further away the aircraft is. Therefore for close proximity fly the pilot will prefer to be close to the aircraft.

## PROXIMITY / SEPARATION DISTANCES /OTHER LIMITATIONS

Standard permissions DO NOT allow for the following:

- Flying within 150m of events or gatherings of more than 1000 people.
- Within 50m of anyone not under the pilots control.
- When taking off and landing, not within 30m of anyone not under the pilots control.
- Over within 50m anything not under the pilots control, public roads, buildings, vehicles, boats etc.
- Near power stations / military installations or other sensitive locations.
- Not within 150m of an urban area unless the aircraft is under 7kg, or extra permissions have been gained.

Note: These are standard permissions, if the filming cannot be carried out within the rules above, then the operator can apply to the UK CAA for extra permissions under an operational safety case, (OSC). This is a complex,

time consuming process and will incur fees from the UK CAA. It is therefore important that you discuss your requirements with the Drone operator at an early stage.

## NIGHT TIME FLYING

Standard UK CAA permission for Drone's does not allow for night time flights, out-with legal daylight hours. However operators can apply for night time permissions supported by a suitable safety case and aircraft systems. At the time of writing the UK CAA is in the process of implementing a new process for application of extra permissions. Please be aware that if this is required, this may take several weeks and can be a costly process for the operator who may pass some or all of these costs on to the client.

## FLIGHT TIMES

Flight times vary depending on the type, size and weight of aircraft. Factors such as temperature, altitude and types of flying can all affect flight times. Most large professional aircraft in the Sub 7kg category will normally be able to fly for around 12-15mins.

## REGULATED AIRSPACE / RESTRICTED AIRSPACE

Professional operators can fly Drone's in most locations in the UK with the correct planning and approvals, there are a few exceptions to this however such as near Nuclear Power Stations, Military installations, sensitive sites, or during certain events with security restrictions.

The UK is broken down into different "Classes" of airspace, Sub 7kg aircraft have permissions to fly in most locations other than the exceptions above.

Large aircraft over 7kg will have more onerous restrictions and require more planning and approvals by the operator.

## MILITARY AIRSPACE

Many parts of the UK are designated as Military Airspace, especially in Scotland from the great Glen northwards. Some of these areas are not active at all times and days. In Scotland many of these areas are only active during weekdays and some only when notified. Permission to fly in these areas can take extra time, at worst up to 28 days. This will normally require the pilot to issue a Notice to Airmen, (NOTAM) and requires extra planning and time. Depending on the planning and approvals required, the operator may charge the client for this extra work in these areas.

## AIR TRAFFIC CONTROL

Depending on the weight class of the aircraft and the location of the intended flight, then the pilot may have to gain permission from the relevant Air Traffic Control authority. Normally this is a simple process, if it is required. For more complex operations additional costs may be passed onto the client for time spent gaining these approvals. The Drone operator will advise if these are applicable once the location of the flights are confirmed.

## LANDOWNER PERMISSION

Drone operators will normally request that the client arranges and provides the landowner approvals for the take-off and landing locations. Some landowners can be onerous in requesting copies of approvals, insurances, risk assessments and method statements. Operators will assist in providing the relevant information as requested.

Clients should note however that as soon as the Drone takes off, then it is classed under the law as an aircraft.

## SAFETY

All operators must operate to the processes and procedures contained in their "Operations Manual". This manual is in effect the "Method Statement" of how they undertake their operations safely. Included in this manual, are pre and post flight checks, risk assessments etc. The pilot must satisfy himself that any flights can be made safely, like full size aircraft he has the final word on whether a flight will take place. The "Operations" manual is submitted and assessed annually by the UK CAA.

Professional operators will predominantly use aircraft with several safety features, and will minimise single points of failure where possible. These aircraft tend to have six rotors / propellers or more, and two batteries. This allows for the aircraft to be landed safely in the event of a rotor or single battery failure. Smaller aircraft such as those with only four rotors will not have this safety feature. These small aircraft commonly tend to be flown with a single battery. It is therefore important to understand the risk involved with some types of aircraft, especially in high risk locations.

In some instances clients or landowners may request a copy of the flight "Operations Manual", especially to ensure the operator satisfies their health and safety requirements. It must be noted that this document is viewed as commercially sensitive and as such the operator will normally require a signed NDA before making this document available.

## CAMERA GIMBALS

Gimbals help keep the camera level in flight, they may also allow control of the camera angles by the pilot or camera operator, depending on their design.

Servo Gimbals:

- Simple lightweight design, now superseded by brushless gimbal, but still used for survey and still images.

Brushless Gimbals:

- 2 Axis, roll and tilt axis only.
- 3 Axis, roll, tilt and yaw axis, (most professional gimbals are of this type)

Most camera gimbals are camera specific, this is due to the need to balance gimbal mechanically for each camera and lens. Some operators can offer generic gimbals, but some functionality may be lost such as the ability of the camera operator to turn the gimbal 360 degrees, or operate in "Dual Operator Mode".

## CAMERAS

At this time the Panasonic GH4 and Sony A7 range are the most common cameras used by Drone operators in mid-level productions, this is due to its ability to record in high bit rates, frame rates and at 4k. The 5D although popular with production companies is heavy for Drone use.

Most aircraft are designed to carry a specific camera and gimbal systems. Some high end systems can be configured for a certain weight range and size of camera, but this requires tuning and setup. Control of the camera may also be limited for these generic gimbals, and they tend to not allow for 360 camera rotation. For more agile flying and longer flight times smaller lighter cameras are more attractive. For high end film work, large aircraft can carry cameras such as the Red Epic, but expect to pay a very high premium for this capability, coupled with shorter flight times and less agile flights.

The cost of systems able to carry cinema camera systems, are significantly more. There are also fewer operators in this end of the market to choose from, and they can therefore charge a premium. At the opposite end of the market some operators can only fly GoPro sized cameras on smaller aircraft.

## COMMON DRONE CAMERA SYSTEMS

- DJI Inspire X3 Camera System , (4k capable but small sensor size and limited dynamic range)
- DJI Inspire X5 Camera System, Micro 4/3 sensor, 60mb/s, up to 4k video.
- DJI Inspire X5 Raw Camera System, Micro 4/3 sensor, High Bit rate, RAW and Shadow files, up to 4k video.
- DJI X4S, 1" Cmos sensor, 100mbs bit rate, up to 4k video.
- DJI X5S, Micro 4/3 Sensor, High Bit Rate, RAW and Shadow Files, up to 5k video.
- Sony A6000, (Broadcast quality 1080, XAVC-S 50mbs Codec)

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## Choosing a Drone / Drone operator for video / film production.

- Sony A5100, (Similar to A6000 and Nex range)
- Sony Nex 5 / 6 / 7 , (Broadcast quality 1080, low bit rate codec)
- Sony A7 range, (4k capable with external recorder on early cameras, on later cameras 4k on board, wide dynamic range and later cameras have on sensor stabilisation)
- Pocket Black Magic, (Broadcast quality, 1080, wide dynamic range)
- Panasonic GH3, (Broadcast quality 1080)
- Panasonic GH4, Micro 4/3 sensor, (Broadcast quality, high bit rate, up to 4k, 100/200mbs)
- Canon 5D, (broadcast quality 1080, heavy for Drone's tends to be used on +7kg aircraft)

Note: Most of these cameras other than the Canon 5D can be carried by a sub 7kg aircraft for operations in urban areas.

## LENSES

Most camera gimbals are designed around specific lenses; typically these are around 12mm to 19mm primes. Although zoom's can be used, they tend to suffer from more vibration. It is easier to move the aircraft than zoom the lens.

## CAMERA CONTROL

Most pilots can control the shutter of the camera in flight, stop and start recording. All other settings such as shutter speed, aperture, focus, will normally be set on the ground before taking off. The exception to this is on the DJi Inspire Drone which allows for changes to the camera settings in the air.

On a single operator setup the pilot can control the tilt of the camera, and moves the aircraft to frame the shot. This results in less smooth tracking shots, and also limits the types of shots that can be made.

On a dual operator setup, the camera operator has 360 degree, 3 axis control of the camera independently from the action of the aircraft. This is the preferred mode for most professional video work, as it allows for more complex camera moves. A separate camera is normally installed for the pilot view.

## FOLLOW FOCUS / ZOOM

Very few operators have the ability to offer follow focus on the aircraft, and if they do expect to pay a premium. Some operators can offer limited zoom of lenses, but in reality the aircraft can be moved closer, and zoom lenses tend to be heavier and can suffer from more vibration. A high end drone with follow focus and camera operator will require three operators to manage it during flight, pilot, camera operator and focus puller.

## AIRCRAFT

Drone's come in many different sizes and configurations, although they will all carry a camera and gimbal of varying weights and size. Professional pilots will prefer aircraft with 6 or more motors as these offer some resilience in the event of a failure. Hexacopter's are the sweet spot in terms of size, weight, stability, safety and flight times.

- Quadcopter's, are one of the more basic aircraft which has four propellers. These tend to be flown with one battery and have more points of failure.
- Hexacopter's have six propellers and can still land safely in the event of a single rotor failure.
- OctoCopter's are used predominantly for lifting larger cameras and have eight motors, they can also land safely in the event of a motor failure.
- Coaxial aircraft have two motors / propellers on the same arm, these tend to be more compact, but are not as efficient so have less flight time. They can feature six or eight motors, and as such they can also land safely in the event of a motor failure. The big advantage of Coaxial aircraft is that they can fly in windier conditions.

## SPARES / BACKUP AIRCRAFT

Many small operators only operate a single aircraft approved for their operations. These types of operators are not recommended as the cost to a production of them being unable to fly due to a failure or breakage is high. Most operators will carry key spares for their aircraft, but is it difficult to cover every eventuality.

For medium and large productions a second backup Drone is desirable. It is important that you confirm this availability with the operator. There may be differences in the features of the backup aircraft, such as different cameras and gimbals.

## GROUND STATION / LIVE VIEW

Most operators will provide a screen or video goggles for clients to view the live video feed from the aircraft on the ground. This allows for the D.O.P to direct the pilot / camera operator. For operators offering dual operator they will normally deploy two live video feeds, one for the camera operator and one for the pilot.

Video feeds can analogue or digital, analogue offers less latency but quality can be poor, more modern systems use an HD downlink of some form, with varying levels of latency.

Some operators may be able to offer low latency HD Live video feeds for aerial broadcast of live events, but the equipment to facilitate this is expensive and has limited range. High power systems may also require approvals from Ofcom. Airborne systems have extra limitations placed on them due to the opportunity for interference over a wider geographic range.

Some operators can also offer a Google Earth type ground station on an Ipad or PC, this allows the operator to view the aircraft location on a map, fly via GPS waypoints as well as other advanced features.

## CAMERA OPERATORS

Most professional aircraft can operate in two different modes, Single operator or Dual operator with separate camera operator. For simple filming a single operator / pilot will be sufficient, however for more complex shoots, or for fluid tracking then a dual operator setup is more appropriate. Dual operator will be more expensive due to the extra complexity and need for a pilot and camera operator. In some instances the Drone pilot may be willing to allow other production crew personnel to operate the camera.

More and more Drones are becoming available which offer pre-programmed flights with waypoint control, virtual zip line, point of interest (360 degree rotation around point of interest) and follow me modes. These allow for complex camera moves while flying the Drone in single operator mode, but require extra setup / programming time.

## GROUND CREW

Drone Operators will require at least one of more ground crew depending on the location and nature of the shoot. The pilot may allow the client or production crew to fulfil this role, but only after suitable briefing / training. Extra ground crew if required will normally be included in any quotes.

## BATTERIES / CHARGING

Batteries in a Drone are similar to those used in mobile phones and laptops, although they have much greater power. Precautions need to be made whilst charging, and these batteries are normally kept in fireproof containers. Depending on the capacity of the battery it can take several hours to recharge. Faster charging is possible, but will reduce the life of the battery. Most Drone operator's compromise on the number of batteries they keep fully charged, as the life of the battery is reduced if left fully charged for long periods. It is therefore better for the operator to cycle batteries frequently, rather than keep large stocks. It is important to understand how many batteries for each aircraft an operator has, to understand how many flights can be made within a certain time frame.

Batteries can be charged on location by most operators, either through a vehicle power supply, or generator. It is important that the operators understands the scope of the work, times and length of flights so that he can plan battery use and charging requirements. If you fail to do this then the operator may run out of charged batteries at an important time of the shoot.

It is also important that the aircraft are not flying whilst waiting on actors or other elements of the production. Use of the Drone needs timed to ensure most efficient use of batteries available.

## FLYING FROM BOATS / OVER WATER

Flying over water generally offers less risk to the public, but more risk to the aircraft. This is especially the case for salt water. Should the aircraft experience a failure, then the aircraft and any footage will be lost. It is therefore important when flying over water that the media is extracted and copied on a regular basis. Flying low over salt water can take its toll on the aircraft systems and cameras and extra time should be allowed for repairs. Some operators may charge a premium due to the extra risk and wear and tear involved in over water operations.

Flying from moving objects is difficult, and is one area where a camera operator / dual operator setup is recommended. Aircraft have a failsafe system that will automatically return the aircraft and land it back at the take-off location, obviously on a moving object then this location may no longer be available. Some systems allow for dynamic setting of this home point but this relies on a good GPS signal.

## FLYING INDOORS

Drone's use GPS both for safety and navigation but also stabilization. Indoors GPS signals are generally poor or not available at all. Therefore some of the safety features of the aircraft will not work. Sensors such as the on-board compass can also suffer interference from power lines, transformers etc. Strong WiFi signals can also cause issues with the video feeds and control system. It is therefore important to understand the risks with flying indoors within buildings and structures.

Generally most aircraft without a GPS signal are not as "locked", and will suffer from some drift. You should be aware of these limitations for any filming by a Drone indoors.

Drone's such as the DJI Inspire 1 / 2, Phantom 3 / 4 and 3DR Solo have new sensors that make it easier to fly without GPS signals, and are the preferred choice for indoor flights, but generally the safety risk is still greater for these types of flights. Newer aircraft also have avoidance sensors which make indoor flying safer but these sensors are not full proof and should not be relied upon.

## WEATHER

The Drone operator will be able to give you details of the weather conditions within which the Drone can fly. Most Drone's cannot fly in winds of more than 20 mph, gusts are especially bad for video work as the camera gimbal may not be able to correct for sudden movement.

Most Drone's are not waterproof as much of the electronics are exposed, so flights cannot be made in the rain. Pilots also have to fly within visual line of sight, so fog and visibility are a factor in deciding if the flight can be made safely. Some operators may have aircraft that can fly in light rain, but shoots may be comprised with rain on the lens etc.

Cold weather can affect some of the electronics and batteries, generally in cold conditions flight times will be reduced. This effect can be minimised by keeping the batteries warm until needed. In cold weather the air is more dense and as a result the Drone will be noisier.

## RUSHES

Although the camera gimbals on Drone's do a good job these days of stabilisation, some rushes may need to be stabilised in post-production. There is a trend to record in 4k for 1080 final production, as this allows for greater stabilisation and cropping. Camera's such as the Panasonic GH4 can record in very high bit rates at 1080 and can consume SD cards quickly.

Confirm with the operator how the media will be supplied, the majority of rushes will be recorded on high capacity SD or MicroSD cards. Some Mac's have issues reading these large capacity drives, so ensure you have alternative means on location to copy the rushes.

Ask the operator to set the camera up for neutral flat colour settings at the highest bit rate possible, however for immediate broadcast work, you may require low bit rate to facilitate quick editing.

Normally the Drone camera will be configured for manual exposure settings, manual WB and manual focus.

## SHOW REELS

Drone operators should be able to offer example videos of show reels, it is better to be offered raw material to understand if any stabilisation has been made to the footage. This will enable to you understand the quality and performance of the camera gimbal used.

## OPERATING IN OTHER COUNTRIES

Europe is trying to harmonise the licensing and pilot qualifications across the Europe Union states. However at this time most countries have their own rules and regulations, some of which can be onerous and expensive to achieve. Some of the qualifications in the UK are recognized elsewhere but the situation is fluid and its best to ask your operator for the latest position.

The LiPo batteries that power Drone's are heavily restricted for transportation by airlines and the UK CAA, making it difficult to carry sufficient batteries for operations. Operators therefore tend to source batteries in the country of operation, which adds additional cost.

With the above difficulties in mind, and the cost of shipping the Drone equipment, it may be easier and more cost effective to source a locally qualified and approved Drone operator.

## SCOPE OF AERIAL FILMING REQUIRED

To allow the Drone operator to provide accurate costs, it is important that he is aware of all of the client's requirements in detail. Location and date of the flights, along with number of flights and types of shots are all important. Failure to provide this information, or change of scope, may result in flights not being made due to lack of appropriate approvals, battery exhaustion, or other restrictions.

## COMMON PRICING MODELS

It is difficult for an operator to quote a standard price, the costs will vary depending on location, approvals and planning, the number of flights and camera systems required.

It is therefore important to confirm the scope of the requirements as much possible to obtain an accurate quote and to avoid any confusion, delay and potential frustration for both parties. Operators will normally include travel time within their daily rates and will charge mileage for locations out-with a certain distance from their base.

Even simple operations will require a few hours planning, charging batteries, pre-flight checks, approvals etc, so the overall flight times may be a small part of what you see. Half day rates are really only appropriate for quick single location shoots as a result.

Quotes from professional operators will typically consist of the following:

- Half Day or Full Day rate
- Aircraft and Camera Systems utilised
- Any testing / configuration of non-standard elements
- Camera Operator, (if required)
- Ground Crew, (min one normally)

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Choosing a Drone / Drone operator for video / film production.

- Media, (if required)
- Mileage
- Approvals, (if required)
- Extra insurance cover, (if required)
- Hire of any equipment, (if required)
- Hotels, meals (if required)

Professional operators will also provide terms and conditions of their services with a written quotation. These are normally based on industry standard terms that most clients will be familiar with.

For Drone work consisting of consecutive days, with the same client, operators will be happy to discuss volume discounts. The more repeat work you do with an operator, the more he may be willing lower his rates. Working with the same client again has many advantages for a Drone operator. Typically the operators overhead will be reduced as the client will be already be familiar with the aircraft, filming capabilities and processes.

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**About the Author(s):** Turkey Red Media Ltd, are a professional Drone/Drone company based north of Glasgow, near Loch Lomond, Scotland. They offer aerial video services to TV, Film and Media, as well as aerial photography and survey services. Turkey Red Media are members of the Association Remote Piloted Aircraft System's UK, ([ARPAS UK](#)). For more details, please visit our website at: [www.TurkeyRedMedia](http://www.TurkeyRedMedia) or follow them on [Twitter](#) or [Facebook](#)

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